WATER CONSERVATION NEWS

"Building sustainability, reliability, and accountability through efficient water use"

In this issue...

CIMIS – Past, Present, and Future

By Bekele Temesgen

The California Irrigation Management Information System (CIMIS) was developed in 1982 as a joint project between the California Department of Water Resources (DWR) and the University of California, Davis (UCD). DWR assumed management of CIMIS in 1985. At the time, the primary objective of CIMIS was to provide reference evapotranspiration (ETo) data to California's agricultural growers. Although agricultural growers still represent the largest user group, the user base has been expanding to include fire fighters, engineers, researchers, educators, landscapers, consultants, meteorologists, lawyers, air quality controllers, pest managers, and many others.

To cope with these growing demands, CIMIS has implemented several changes to its program over the years. These include, but are not limited to, developing stringent data quality control (QC) criteria, installing new CIMIS stations, and changing data acquisition and dissemination methods. The CIMIS QCs were developed to help users identify potential data quality problems. Problems with CIMIS data quality can be the result of sensor malfunction, sensor deterioration, unexpected obstruction of sensors, abnormal weather, and communication problems between the datalogger and the central computer. Statistical and scientific tools are used to identify and flag the data. Once flagged, users make their own decisions regarding whether to use the data or discard it. It should be noted that flagging a datum does not necessarily imply erroneous data as it can very well be because of extreme weather conditions.

The CIMIS network has grown from 43 stations in 1985 to over 124 active and 62 inactive stations at present. DWR continues to make considerable effort to expand the CIMIS program and its use by educating users through workshops, conferences, and publications. However, local users have the responsibility of initiating and funding new CIMIS stations. Equipment cost for a new CIMIS station is approximately $5,000. Some local, state, and federal agencies provide funding for the purchase and installation of stations. For more information on funding sources and installation of stations, contact your local CIMIS representative by visiting our Web site at www.cimis.water.ca.gov.

CIMIS data acquisition was initially via the dial-up system. Telnet and the web were introduced in 1995 and 1996, respectively. Between 1996 and 2002, users were accessing and retrieving data using the dial-up, telnet, and/or web systems. Resource limitations forced CIMIS to terminate the dial-up and telnet options in 2002, leaving the web as the only option for retrieving CIMIS data. Since its initial release, the CIMIS web site has undergone two major upgrades. Currently, it is in the process of upgrading to yet another level as described on the following pages.

Continued. See "CIMIS" on page 2

Water Conservation News provides information on water use efficiency developments. This free newsletter is published quarterly by the California Department of Water Resources, Office of Water Use Efficiency.

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Water Use Efficiency Office
(916) 651-9236
Marsha Prillwitz
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Manucher Alemi
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Kent Frame
CIMIS
(916) 651-7030

Water use efficiency information is also available from DWR district staff:

X. Tito Cervantes
Northern District
2440 Main Street
Red Bluff, CA 96080-2398
(530) 529-7389
Ed Morris
Central District
3251 S Street
Sacramento, CA 95816-7017
(916) 227-7578
David Scruggs
San Joaquin District
3374 E. Shields Avenue
Fresno, CA 93726-6990
(559) 230-3322
David Inouye
Southern District
770 Fairmont Avenue
Glendale, CA 91203-1035
(818) 543-4600

We welcome any comments, suggestions, and story ideas; please send them to:

Water Conservation News
Editorial Staff
Department of Water Resources
Office of Water Use Efficiency
P. O. Box 942836
Sacramento, CA 94236-0001

E-mail: goettl@water.ca.gov
Telephone: (916) 651-9605
Fax: (916) 651-9849

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CIMIS

Continued from page 1

Current Web Site Upgrade

The CIMIS web site is currently upgrading to use the Java powered Struts-based framework. This allows future CIMIS applications to be developed and enhanced more effectively and enables the system to take advantage of powerful new tools and features that add value. Web clients will find the new Struts-based web site easier to navigate and understand. The frameless design provides better navigation and the ability to segment portions of the web page for different purposes. Most of all, it provides these benefits with less screen real-estate than the current system.

The resources available from the upgrade will be more informative and dynamic with a comprehensive section on station descriptions and activities, including updated surrounding land use changes. Another important new feature will be the "My CIMIS" page that provides personalized features tuned for individual web clients, such as having "favorite station lists", smart reports that remember reporting preferences, and single-click reporting. The technical architecture and system design will continue to allow the CIMIS system evolve and expand to meet future needs, including the use of remotely sensed data.

Remote Sensing

Spatial data gaps have been one of the challenges of the CIMIS program. If a hypothetical assumption is made that the CIMIS stations are distributed uniformly, a single station represents approximately 1300 mi^2 of California's land area. Consequently, there exist definite data gaps of ETo and other weather parameters in many regions of California.

Advances in remote sensing technologies have made it possible to derive certain weather parameters on large spatial scales from measurements of reflected and/or emitted radiant energies. Coupling these parameters with *in situ* measurements from CIMIS weather stations can potentially produce spatially distributed values of the whole spectrum of weather parameters needed in the estimation of ETo. This, in turn, can lead to the mapping of ETo on a regional scale.

CIMIS is currently exploring this potential by initiating a project with the UCD remote sensing group. This project, known as the GOES Project, involves deriving solar radiation from the Geostationary Operational Environmental Satellites (GOES) at 2-kilometers resolution and interpolating air temperature, wind speed, and relative humidity from point measurements at the CIMIS stations. Because interpolation methods introduce inaccuracies that could lead to significant cumulative errors, the use of GOES sounder data to derive these parameters is planned in the next phase of the project. The goal is to produce a map of daily ETo that is interactively available on the web. Although much remains to be done, preliminary results are encouraging.

Continued next page -

Mission Statement of the Office of Water Use Efficiency

In cooperation with others, we promote the efficient and beneficial use of California's water resources to sustain our human and natural environment.

Non-Ideal Site Studies

Calculations of ETo require that the weather stations be sited on standardized vegetation surfaces (grass or alfalfa). Standardization of surfaces on which weather stations sit requires, among other things, that they be fully covered with well watered, actively growing vegetation. Such surfaces are referred to as "reference" surfaces whereas those that do not conform to the standardizations are known as "non-ideal" surfaces.

Many areas of the state, including urban settings, do not have reference sites. Therefore, CIMIS is in the process of conducting a statewide study to investigate the possibility of installing stations in non-ideal environments and converting the collected data into an equivalent reference condition. This would be achieved by setting up paired reference and non-ideal stations in a given study area and correlating the data.

The current non-ideal site study is a continuation of a similar study that was funded by the California Urban Water Conservation Council (CUWCC) and conducted by UCD cooperative extension in the year 2000. Although it was done on a smaller scale, the study found that it is possible to use non-ideal sites for ETo estimation, provided that a feasibility study has been conducted at the site. The study recommended that DWR and CUWCC form a technical committee whose main goal is to find temporary sites for further feasibility studies in different regions of the state. Accordingly, CUWCC is currently facilitating the search for non-ideal sites within its member agencies. The CIMIS staff will visit a site and make decisions on its suitability. If approved, data will be collected for some period of time and correlations will be developed between the reference and non-ideal sites. Anyone interested in participating in this study can contact CIMIS staff.

ET Based Irrigation Controllers

One of the fastest growing segments of CIMIS data use is with evapotranspiration (ET) based irrigation controllers, also known by many as "ET Controllers." ET Controllers are devices that receive ETo data and control irrigation based on water demands of a specific plant. There are different types of ET controllers depending on the frequency of the input data that they use. Some use historical (long-term average) ETo data and others use real-time data. Some of those that use historical ETo data modify it based on measurements of a single weather parameter, such as air temperature.

The term "real-time" is relative in that it can be used to imply instantaneous, hourly, daily, and/or weekly data. Instantaneous and hourly data are usually used for modeling purposes. A very good example for instantaneous CIMIS data demand is the Hilgard project, which is being developed by the Viticulture and Enology Department at UCD. The project is designed to collect real-time (instantaneous) and historical data from vineyards and wineries and making them available to anyone interested via the internet. The data can be used for control algorithms and modeling purposes in research and teaching. CIMIS is currently in discussion with the department at UCD to explore the possibility of providing such data without interfering with normal operations of its program.

In the context of ET controllers, "real-time" is commonly used to refer to the daily data since it is used for irrigation scheduling purposes. ET controllers are designed to save water by efficiently scheduling irrigation systems and applying the right amount of water at the right time. Investigations are currently under way to determine potential water savings that can be realized by using ET controllers. DWR has recently awarded Prop 13 urban grant funds to the East Bay Municipal Utility District, Municipal Water District of Southern California and the City of Los Altos to conduct such an investigation. Work on these projects is scheduled to begin in October 2003 and results from the study are expected to provide valuable information.

Improving Evapotranspiration Estimates

By Bekele Temesgen and Kent Frame

The California Irrigation Management Information System (CIMIS) was developed in 1982 with the objective of providing evapotranspiration (ET) estimates. ET has many applications in different fields that, directly or indirectly, affect California's water resources. As demand for the state's limited water resources increases, accurate estimates of ET become very important. The accuracy of ET estimates depends on many factors including the precision with which the weather parameters are measured and the equation used. Weather parameters such as solar radiation, air temperature, relative humidity, and wind speed affect ET significantly. Plant factors such as type, height, leaf area, density, and the stage of growth also affect ET. Since it is not practical to develop ET equations for every plant type under different weather and environmental conditions, scientists developed an idea of measuring weather parameters from standardized reference surfaces such as grass and alfalfa and calculating what is known as reference ET (ETo). CIMIS calculates its ETo values using the modified Penman equation.

Continued. See "Estimates" on page 5

Water Management and Technologies on the Move

By Baryohay Davidoff

California's climate, soils, and topography provide ideal conditions for production of food and fiber. A variety of crops well suited to the state's conditions are produced on about 9 million acres of irrigated farmland. The most important variable for optimum production of food and fiber in California is water. Growers, irrigation districts, farm advisors and irrigation specialists, private consultants and organizations, manufacturers of irrigation hardware and state and federal agencies, including educational and research institutions, take pioneering steps to manage California's scarce water resources and improve efficiency. This is possible through irrigation management and technology.

Knowing when to irrigate and how much water to apply is key for good irrigation water management. Growers use evapotranspiration data and soil moisture data for such prudent irrigation scheduling. Tensiometers and gypsum blocks and other technologies to estimate soil moisture and plant water content status are in wide use. Over 100,000 inquiries per year are made to the California Irrigation Management Information System alone. This automated and computerized system provides quality and timely weather information, specifically data on evapotranspiration from a particular area or region. Such data, along with soil moisture information, is critical for irrigation scheduling. Growers utilize satellite technology for fertility management, crop uniformity and quality improvements. Likewise, growers use automated and computerized irrigation systems for irrigation, fertilizer and pest management. Many growers are also using real time satellite weather information and forecasting capability systems. Such technologies are in use for cash crops, such as strawberries of the Salinas Valley.

The majority of orchards and vineyards in the state are under pressurized irrigation systems with almost all trees and vines established during last five to ten years under drip irrigation. A report from Cal Poly indicates that between 1990 and 2000, acreage with drip irrigation in California grew from .8 to 1.9 million acres. Likewise, sprinkler irrigation systems increased from 2.3 to 2.8 million acres, while gravity irrigation systems such as furrow and flood irrigation systems declined from 6.5 to 4.9 million acres.

The shift to pressurized irrigation systems often requires modernization of the water delivery systems. Increasingly, irrigation districts are upgrading and automating their systems to allow for precise, flexible, and reliable water deliveries to their customers. They are reducing system losses by lining canals or converting to pressurized systems, developing spill recovery and tail water return systems, improving pump efficiency, and implementing conjunctive use programs.

Additionally, many growers implement Regulated Deficit Irrigation. RDI is an irrigation management strategy that purposely stresses the trees or vines at specific developmental stages with the goal of inducing a desired agronomic feature, often crop quality, in the plant. Such practice may also reduce crop water use, decrease disease or pest infestation, and/or reduce production cost without reducing profit. RDI is used primarily on tree and vine crops where crop quality as well as yield is of primary concern. Wine grapes are a clear example where mild stress imposed through the growing season decreases canopy growth but produces grapes with higher sugar content, better color, and smaller berries with higher skin to fruit volume ratio.

It is well known that water deficit at some specific growth stage of winegrapes increases sugar content, increases the ratio of the grape skin to the total volume of the fruit and hence produces higher quality wine. Higher sugar content, and intense flavor, bring higher value for wine produced and higher gross revenue, even when total yield is reduced. Winegrowers in the Sierra Nevada Foothills , San Joaquin Valley North, Sacramento River Delta, Sonoma County, and other areas of the state practice deficit irrigation.

On a larger scale, districts use new and innovative technologies and programs. Technologies to line leaking canals, automate and increase flexibility of water delivery systems, construct regulatory reservoirs, increase on-demand availability of water, develop spill recovery and tail water return systems, use telemetry to better manage water delivery and distribution systems, develop tiered water pricing and increase water reuse are becoming more commonplace in California, along with low-interest loan programs. Many local agencies have made such advancements in using technologies to better manage irrigation water.

A number of irrigation districts in the east side of the San Joaquin Valley have state-of-the-art technologies to better manage water distribution and water delivery systems. During the past few years, Oakdale Irrigation District has improved its main canal from the Stanislaus River, built a 1,260 acre-foot regulating reservoir at a cost of $2.1 million dollars and installed automated flow control technologies which now are fully operational. OID also installed a broad-crested weir, including installation of automated gate and Supervisory Control And Data Acquisition (SCADA) control system to better measure, control and deliver water.

Continued next page -

OID is currently working to develop a water measurement plan to further refine its water balances and water budget.

The Alta Irrigation District implemented innovative water measurement and water regulating basins. To allocate, distribute and determine the volumetric cost of water to multiple water users, water measurement is essential. In March 2000, the Alta Irrigation District initiated volumetric measurement, in addition to the existing per acre charge. The district intensified its effort to improve the measurement of water to approximately 4,000 agricultural water users, resulting in minimizing spill and improving the control of water deliveries in the lower reaches of the district. Several regulating basins (two 60-acre facilities) were developed to collect inflows and measure outflows to meet water demands. Historically, the lower 20,000 acres weren't extensively farmed. With the area being developed into intensive agriculture, the district enhanced flexibility and control in its distribution system to improve water delivery reliability and reduce groundwater pumping, especially in wet years. These improvements have resulted in better control of water deliveries and incentive for the water user to conserve water, as well as improved use of surface water deliveries to offset groundwater pumping.

In many water districts on the east side of the San Joaquin Valley there has been a significant growth and conversion—10 to 20 percent during the last five years—from flood irrigation to drip and micro sprinkler irrigation on permanent tree and vine crops. Ten years ago most of the land in this area was flood irrigated. Most permanent crops being planted today are using drip or micro sprinkler irrigation systems. Installation of canal gates to measure water and SCADA controlled structures to regulate canal flows are completed or are under way in many districts in this area. Concrete lining of canals to prevent excessive water percolation and building regulating reservoirs are measures that have helped water flow control, water measurement, and delivery systems.

For details on these and other water management technologies call Baryohay Davidoff at (916) 482-4324 or visit wwwdpla.water.ca.gov/agriculture/management.

Estimates

Continued from page 3

However, for the benefit of interested users, CIMIS has also started reporting ETo values estimated using the Penman-Monteith equation. Once ETo is estimated, the actual ET for each crop (ETc) is calculated using a crop factor known as crop coefficient (Kc). Kc values are usually developed by measuring ETc and correlating it to ETo. Therefore, the quality of ETc data depends on the accuracy of both ETo and Kc. CIMIS is currently in the process of conducting research on these important parameters using lysimeters and net radiometers.

The Lysimeter Study

The University of California, Davis cooperative extension has developed lists of crop coefficients that can be used with the CIMIS ETo and published them as leaflets. However, these lists are incomplete since they do not cover all crops growing in California and some were based on estimation rather than measurements of ETc. Also, crop characteristics may have changed over time. For these reasons, CIMIS initiated a research with the objective of refining and updating Kc values. CIMIS is cooperating with the United States Department of Agriculture and conducting a lysimeter study at Five Points in Fresno, CA. Two weighing lysimeters have been installed and are currently collecting data that will be analyzed in the future. A CIMIS station is located nearby to compare the ETc measured by the lysimeters to ETo from the station. Results from the study will be released to users as they become available. For additional information contact Kent Frame at (916) 651-9679, e-mail kframe@water.ca.gov.

Net Radiation Study

Evapotranspiration involves the conversion of liquid water to a water vapor using a significant amount of energy from the sun. The energy from the sun (solar energy) travels across the space and atmosphere to reach the earth's surface. In the process, fractions of the incoming solar energy are reflected and absorbed by the atmosphere and the surface. The absorbed energy heats the surface, which in turn radiates it back to the atmosphere in the form of longwave radiation. The balance between the incoming and outgoing radiation is known as net radiation (Rn). In other words, Rn is the amount of energy that is available at the surface for evaporating the water and heating the air and the surface. It is the most important parameter in the estimation of ETo and needs to be as accurate as possible. A recent study by the Office of Water Use Efficiency staff compared ETo and Rn values calculated using the CIMIS Penman and the more widely used Penman-Monteith equations. As reported in the April 2002 issue of *Water Conservation News*, although there were no significant differences in ETo, Rn estimated by the two equations showed significant differences. The study then recommended that CIMIS measure Rn using net radiometers and compare the estimates from the two equations to the measured values. Accordingly, CIMIS is installing three NR Lite and one CNR1 net radiometers in different regions of the state to measure Rn. The measured values will be used to determine the method that produces more accurate Rn in California.

New Looks for Front Yards

By Julie Saare-Edmonds

An exciting trend is slowly but steadily sweeping across the country in the field of urban landscaping—front yard gardens. Some of these gardens are very natural with native grasses and other native plants that take on the look of meadows or prairies or chaparral while others are very formal with carefully divided and manicured beds. Most, however, are somewhere in between. What they all have in common, though, is that the owners converted their front yards that were once nearly completely lawn to gardens that have little or no lawn.

There are many reasons why gardeners are giving up their lawns and starting front yard gardening. Some gardeners object to the time, expense and frustration spent on maintaining lawns in the presence of harsh summer climate, compacted soil, grubs and other pests and diseases. Others are concerned with the amount of water and fertilizers required to maintain a lawn, the effects caused by the fertilizers and other contaminants in the runoff, the amount of green waste that ends up in a landfill, and the air pollution mowers produce. Still others may find their turf yards boring and sterile and notice that birds and butterflies have no reason to visit. Neighbors rarely stop to admire a lawn but they do stop to admire flowers and garden art. A front yard garden is a perfect place to get to know *all* of your neighbors, both the human kind and the wild kind.

A vibrant example of a cottage garden.

Converting a front yard is a lot of work, like any landscape project, but the results can be rewarding. Careful planning, good plant choices, and a good irrigation design are essential to make any landscape project a success. After the initial conversion, maintenance of these new landscapes, whether they be perennial, shrub or groundcover beds, rock gardens, native grass gardens or even herb and vegetable gardens is usually the type of work that makes gardening the most popular hobby in America.

Lawns do serve an important function for recreation, but often children play in the back yard and the front lawn is rarely used. If you find that the lawn in your front yard isn't living up to your expectations, perhaps reducing the size or eliminating it altogether would be a wise choice to make your landscape easier to manage and water wise.

Southern California Heritage Gardening *is a program sponsored by Metropolitan Water District of Southern California and its member agencies to bring back the look and feel of California's past. Heritage gardening allows the region's natural seasons to be expressed and reminds gardeners of the beauty that existed before the landscape was changed by the introductions of many non-native horticultural plants. Heritage gardening involves the use of California natives and other "California Friendly" plants, meaning those that come from other dry Mediterranean climates. By using such low water-using plants with efficient irrigation systems, a resident can save two-thirds the water used in a more traditional landscapes and enjoy a natural garden setting. For more information about this program visit http://bewaterwise.com.*

Water Wise Gardens are Within Your Reach

By Julie Saare-Edmonds

The Ruth Storer Garden at the UC Davis Arboretum.

Throughout California there are many water wise demonstration gardens planted for the enjoyment of all. These gardens are planted at water agencies, schools, libraries, universities, zoos, parks, and even at great estates. They are meant to educate the public and demonstrate that plants that happen to be low-water-using are attractive, colorful and easy to grow in different climates and conditions..

Some people think that low-water-using plants are dull, don't flower, or are temperamental, but this is not often true. In most cases this couldn't be farther from the truth. Think of *Lantana*, lavender, the many sages, yarrow, *Coreopsis*, *Plumbago*, rosemary, *Gazania*, and bottlebrush. All are colorful, easy to grow and require little water. The best news of all is that there are many more plants like them. It's hard to imagine what a plant will look like or how big it will get in the nursery pot. Water wise demonstration gardens are great places to see plants in a garden setting.

To find a water wise garden to visit near you and to get information about the gardens including, location, hours, and contacts visit www.usbr.gov/mp/watershare/resources/gardens.cfm.

Alfalfa Soil Moisture Sensors

By Peter Brostrom

Soil moisture monitoring won't solve all of the problems related to irrigation management. However, researchers have found that relatively simple and inexpensive techniques (using new soil moisture monitoring equipment) can go a long way in improving growers' ability to use water efficiently in alfalfa fields. Steve Orloff, Blaine Hanson and Dan Putnam with the University of California Cooperative Extension Alfalfa Workgroup have published *Soil-Monitoring: A Simple Method to Improve Alfalfa and Pasture Irrigation Management.* The pamphlet provides guidelines for using electrical resistant block sensors to track and record soil moisture through the growing season. Sensors give growers a simple, but quantified, method of irrigation management.

Experiments conducted in Scotts Valley have shown significant improvements in water management with soil moisture monitoring. One soil-moisture monitoring site per field (with fields ranging from 20 acres to 160 acres) is usually sufficient, but the site should be established in an area that is representative of the field. For fields with variable soil types, a second or third monitor site can be added. Three sensors are used per site with the sensors set at 1 foot, 2 feet and 4 feet. The sensors are installed by using a soil probe or auger to core a hole to correct the depth. The sensor is pushed to the bottom of the hole and the hole is backfilled with soil leaving the electrical leads just below the soil surface. The leads are kept below the surface in a small trench to prevent damage from field equipment, but close enough to the surface so that the sensors can be easily read or downloaded. The sensors can be read manually or connected to a datalogger. Manual readers cost between $200 and $300, and can be used on a number of fields. Dataloggers record sensor readings on an hourly basis and reduce the time required to take manual readings. They can cost from $150 to $300 and can be used only at one site. The UC researchers used Watermark sensors, but there are several different brands of resistant blocks available. The pamphlet can be downloaded from the UC Davis Alfalfa Web site http://alfalfa.ucdavis.edu or www.plantmanagementnetwork.org/pub/cm/management/2003/moisture.

Also available at the UC Davis Alfalfa site is an Excel spreadsheet template that makes it easy to plot and graph soil-moisture data over the growing season. Soil moisture graphs enable growers to evaluate past irrigations and use current soil drying rates to estimate when to schedule the next irrigation. Soil moisture sensors give readings in centibars, a measurement of soil moisture tension. The greater the number, the drier the soil.

Researchers Dan Putnam and Blaine Hansen working with the soil sensors in an alfalfa field.

Continued. See "Alfalfa" on page 9

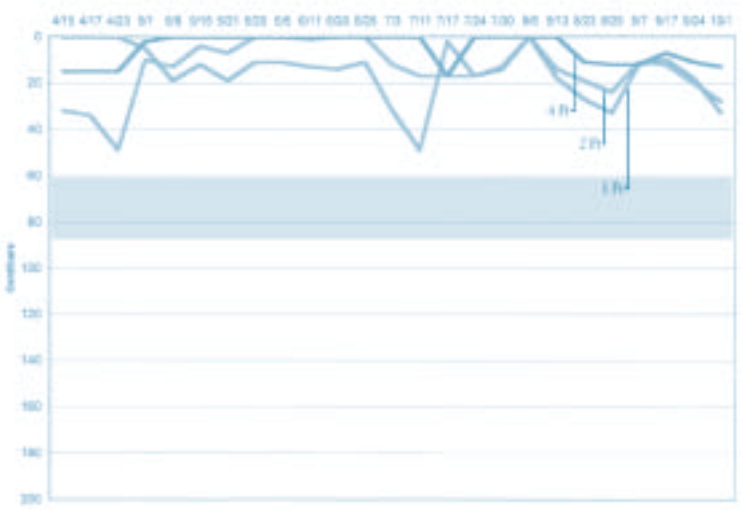
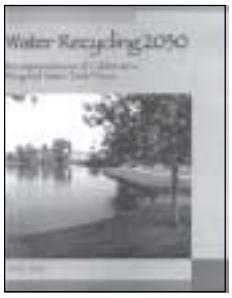


Figure 1: Soil moisture monitoring results showing over-irrigation of alfalfa using sprinklers (most soil moisture readings are low, indicating the soil rarely dries out between irrigation).

Figure 2: Soil moisture monitoring showing good water management. This grower allowed some depletion before irrigating to replenish the profile.

Governor's Recycled Water Task Force Finds Additional Source of Water for California

By Fawzi Karajeh



The Governor's Recycled Water Task Force in its June 2003 report identified a significant additional source of water for the State of California- recycled water. The Recycled Water Task Force foresees the potential of quadrupling recycled water use in California over the next 30 years. Doing so would free up enough potable water to meet 30 to 50 percent of the domestic water needs of the 17 million new Californians expected by 2030. That quantity would be the equivalent of one-third the water stored behind Oroville Dam in Lake Oroville, a reservoir with a storage capacity of 3.5 million acre-feet.

Among the Task Force recommendations were:

- Expanding funding for health research, recycling projects, public awareness, and academic programs
- Engaging the public in an active dialogue in the media, communities and schools across California
- Adopting uniform statewide regulations for dual plumbing and indoor use of recycled water

Other essential parts of the solution will include conservation, improved storage, desalination, and voluntary water exchanges. Recycled water use is currently about 500,000 acre-feet and would rise to about 2 million acre-feet under the plan.

The Task Force report is available online at www.owue.water.ca.gov/recycle. Printed copies are available by contacting DWR at (916) 653-1097. For more information about the Recycled Water Task Force contact Fawzi Karajeh at (916) 651-9669 or fkarajeh@water.ca.gov.

Helping to Solve California's Energy Problems with Recycled Water

A summary of an original article by Greg Baatrup, Delta Diablo Sanitation District, Antioch California

In the late 1990s, energy shortages and incredible prices had a very significant impact on the California's residents and businesses. The state, through the Energy Commission, has considered dozens of power generation projects to meet the demand requirements. Most of these projects are gas-fired generation facilities with significant cooling and process water needs. Through a project completed in March 2001, the Delta Diablo Sanitation District was able to provide up to 12.8 million gallons per day of cooling and process water to two new power generating plants in Pittsburg, California. The plant started operation and water deliveries in June 2001 and has operated continuously since then. Through July 2003, DDSD has delivered more than 4.0 billion gallons (12,300 acre-feet) of recycled water.

A 12.8 mgd recycled water facility, Delta Diablo Sanitation District.

Recycled Water Demand

Customer	*Typical Day (mgd)*	*Peak Day (mgd)*
Los Medanos Energy Center	2.86	5.41
Delta Energy Center	3.34	6.89
Irrigation	0.15	0.15
Total	6.35	12.45

Two of the new power plants, located in the City of Pittsburg, California, will receive cooling water from the Delta Diablo Sanitation District. The Los Medanos Energy Center is a 550-megawatt cogeneration power plant located approximately three miles from the District's wastewater treatment plant. The Delta Energy Center is a 880-megawatt power plant located adjacent to the wastewater treatment plant. Additional uses of recycled water as part of the project include boiler feed to LMEC and irrigation water to parks in the City of Pittsburg. LMEC will use recycled water for boiler feed to create steam to drive the steam turbine. Recycled water will undergo extensive water treatment and purification at LMEC before being used as boiler feed. As required mitigation to the Pittsburg community for the power plants, several new parks are being constructed and will use recycled water for irrigation. The recycled water demand for each facility is shown below. For more information contact Greg Baatrup of Delta Diablo Sanitation District, at (925) 778-4040.

New Law Elevates Status of Desalination

By Fawzi Karajeh

Author of Assembly Bill 314, Assemblywoman Christine Kehoe, D-San Diego

Assembly Bill 314 (Kehoe) – *Desalination*, signed into law by Governor Davis, will be effective in January 2004. This law gives water desalination projects in California equal footing for state water funding with other water supply development projects such as dams, aqueducts, and surface and groundwater storage. Author of the bill, Assemblywoman Christine Kehoe, D-San Diego, said in a press release, "California has invested heavily in other types of water supply and water-quality projects, but up to now there has not been a serious commitment to develop desalination projects."

The new law requires the state to undertake a policy that gives water desalination projects (seawater as well as brackish groundwater desalination) developed by or for public water entities the same opportunities for assistance and funding as other water supply reliability projects. The law, which amends Section 12947 of the Water Code, is based on the legislative finding that desalination technology is now feasible and can help meet the state's growing water needs by providing significant new water supplies from seawater, brackish water, and reclaimed water. By this legislative directive, the Department of Water Resources will explore economic and efficient methods for water desalination so that desalted water may be made available as a component of the state's water supply portfolio to meet current and future water needs.

Assembly Bill 334 Gives Communities Additional Flexibility to Regulate Water Softeners

By Fawzi Karajeh

On August 3, 2003 Governor Davis signed into law AB 334 (Goldberg) *Water Softening and Conditioning Appliances*. The bill allows local agencies such as cities and water districts, after conducting technological and economic feasibility studies of alternatives, to restrict the use of the self-regenerating water softeners, also known as automatic water softeners or rock salt water softeners, that use either sodium chloride (rock salt), or potassium chloride (potassium tablets or crystals). The salt generated using such water softeners results in excessive amounts of salt ending up in the wastewater. These salts are difficult to remove using traditional treatment processes. Additional treatment—needed to remove the salt—would increase the cost of recycled water, making it economically more challenging to advance the safe use of this important, reliable water source.

Districts are encouraged to develop or broaden their information and education programs on water softeners.

Automatic water softeners

These programs should provide homeowners desiring water softening with alternatives to rock salt water softeners. These alternatives could include filtration, activated carbon, or reverse osmosis treatment units, as well as contracting with a water softener service provider that uses the exchange tank devices, which are recharged offsite and eliminate the need to discharge excessive salt in the local wastewater. For a copy of the bill go to: www.leginfo.ca.gov/pub/bill/asm/ab_0301-0350/ab_334_bill_20030804_chaptered.html.

Alfalfa

Continued from page 7

An example of a soil moisture graph is given in Figure 1. Figure 1 shows excessive irrigation in an alfalfa fields, as the soil moisture in the first foot of soil rarely reaches 40 centibars (30 centibars is consider field capacity for this soil). The lower depths are even wetter than the upper level. The allowable depletion, when measured by centibars, differs greatly by soil type. On sandier soils, a lower threshold for irrigation (40 to 50 centibars) is expected, whereas clay loams will hold more water, and thereby a higher threshold (60 to 120 centibars) is recommended. These sensors are not recommended for very sandy soils, since the sensors may not interact significantly with the soil matrix, and may misrepresent the true moisture status. Figure 2 shows a field where the soil has been allowed to dry out to between 60 to 90 centibars, but the profile has been mostly recharged by the irrigation events. This field showed little water stress, and irrigations were applied only when soil depletion occurred.

The UC researchers are continuing to work with growers with the soil moisture sensors and other aspects of alfalfa irrigation. The work is funded with a grant from DWR's Office of Water Use Efficiency and the California branch of the National Resource Conservation Service, US Fish and Wildlife Service and US Bureau of Reclamation.

California Urban Water Conservation Council

By Mary Ann Dickinson, Executive Director

Borrow the Latest Technology

Are you interested in measuring the flush volume of a toilet? Would you like to check your distribution systems for leaks with the latest ultrasonic equipment? Then the California Urban Water Conservation Council has specialized equipment for you. As part of its member benefits, CUWCC has acquired a $1,000 "T5 Flush meter" that measures the flush volume of any gravity tank-type non-pressured toilet. This Flush meter is available for loan to member water agencies that might be undertaking residential survey programs or toilet inspection/verification efforts. Also, available for loan are four sets of Health Scope Leak Detection Equipment, which CUWCC was able to purchase with U.S. Bureau of Reclamation grant funds. The only requirement for borrowing this equipment is that the member water agency have completed a system water audit in advance and that the agency's personnel have training on the use of the equipment. CUWCC will continue to search for opportunities to purchase equipment for loan to its members. For more information contact CUWCC at (916) 552-5885 or visit the members only area of the CUWCC Web site at www.cuwcc.org to sign up for the equipment loan.

New Publication

CUWCC is pleased to announce the addition of a new manual to its publication list: The *Water Loss Control Manual*, by Julian Thornton. CUWCC is offering the Manual, normally listed for $99.00, for $80.00 plus shipping and handling. This discount is especially noteworthy because this manual is the premier text today on managing water losses from water utility distribution systems, using the latest methodology of "performance indicators" developed by the International Water Association and recently approved for general utility use by the American Water Works Association. The term "unaccounted for water" is officially dead. Only a few water utilities in California have begun to manage their distribution system losses according to this new, more comprehensive methodology, although the future trend is clear toward the "performance indicators" as a new management strategy. In fact, CUWCC is considering amending its BMPs on System Water Audits and Leak Detection to focus on the performance indicators instead of the outdated "unaccounted for water" approach. Following the new approach should produce more utility water savings as a result of improved water management. The manual is available by calling (916) 552-5885 or online at www.cuwcc.org.

The Future of Best Management Practices

The 14 BMPs that are the foundation of urban water efficiency in California are just the beginning. There are many other opportunities for water conservation, particularly as new technologies emerge that were not available before. The Memorandum of Understanding recognized this when it created a process for identifying "potential" best management practices for future adoption by CUWCC. A number of new technologies are currently being examined by CUWCC in a study now under way on potential BMPs. New devices such as weather-based irrigation controllers, steam sterilizers in hospitals, commercial dishwashers and food steamers in restaurants, no-flush urinals, dual-flush toilets, hyper-efficient showerheads, and icemakers in restaurants and hotels are all part of CUWCC's overall study, which will be conducted over the next three years. Watch for annual updates on the study's process, which will be available beginning in early 2004. Devices which may be suitable for adding to the Best Management Practices list will eventually be submitted to CUWCC's membership for approval. For more information call (916) 552-5885.

Product News

CUWCC's Web site has an entire section devoted to news of water-efficient products and devices. The centerpiece of the Product News section is the Waterlogue, a periodic electronic newsletter giving the latest developments on testing, specification adoption, and consumer acceptance of devices. The products range from toilets, showerheads and washing machines, and weather-based irrigation controllers and waterbrooms. An index of topics covered in past issues is also posted on the site, along with actual recommended product specifications. Visit the Product News Section of CUWCC's Web site, www.cuwcc.org.

Water Conservation Events

24th Annual International Irrigation Show

San Diego, California
November 18 to 20, 2003
Education and Certification:
November 15 to 20

If you're involved with irrigation in agriculture, landscape, turf, or golf you need to attend the world's largest show totally dedicated to irrigation. If you design, sell, manage, install, or maintain irrigation systems, plan now to be in San Diego for the world's largest all-irrigation show.

- See the biggest selection of irrigation-related products and services—all under one roof.
- Learn firsthand about the industry's newest and most advanced water management tools.
- Meet valuable new contacts, take education classes designed specifically for irrigation professionals, take an industry field tour, and more.

For more information visit www.irrigation.org/ia_show.htm.

United States Committee on Irrigation and Drainage ET Workshop

(In Cooperation with the 24th Annual International Irrigation Show)
San Diego, California
November 17, 2003

The Workshop will provide the specifics of the ASCE/EWRI standardization of reference Evapotranspiration (ET) calculation. It addresses the concept of the definition of reference ET, how to make the various calculations, how to organize and screen weather data, and how to use the standardized ET reference with various types of crop and landscape coefficients. The Workshop will include practice calculation exercises. Participants are encouraged to bring notebook computers to use the software and data that will be provided. For more information visit www.irrigation.org/ia_show.htm.

13th Annual California Water Policy Conference

Los Angeles, California
November 19 to 20, 2003

The 13th annual California Water Policy Conference has announced that its next conference, "Juggling Our Water Future," will be held November 19 to 20, 2003 in Los Angeles. Pat Mulroy, General Manager of the Southern Nevada Water Authority is confirmed as the opening keynote speaker and will talk about what California and Nevada can learn from each other as both states plan for an uncertain water future with many common challenges. For more information visit www.cawaterpolicy.org.

Eco-Landscaping "Profiting from a Green Future" - Seminar and Trade Show

Sacramento, California
January 10, 2004

This seminar will present cutting edge trends and techniques to address efficient water use, storm water runoff problems, resource conservation and pesticide and fertilizer reduction and alternatives. Breakout sessions will include information about plants and design concepts and techniques and products for contractors to begin implementing new ideas to solve old problems. This show is for landscape architects and designers, installation and maintenance contractors, nursery professionals, golf course and park grounds maintenance managers, horticulture students, and public agency professionals that are involved with landscaping, land use, pesticide regulation, or water issues. It will be held at Sam Pannell Community Center, 2450 Meadowview Road. For more information call (916) 444-6458 or visit www.ecolandscape.org.

Sacramento Valley Landscape and Nursery Expo

Sacramento, California
January 15, 2004

Mark your calendars for the Sacramento Valley Landscape and Nursery Expo to be held at the Sacramento Convention Center. The Sacramento Valley Landscape & Nursery Expo is Northern California's premier landscape and nursery show. Exhibitors include landscape, nursery, erosion control, and golf industry supplier, representatives and manufacturers. For more information visit www.sacvalexpo.com.

Mark your Calendar January 27 to 28, 2004

California Irrigation Institute Conference Transfers: Implications of Moving Water
(in Sacramento)

For more information visit
www.caii.org/a.html

WATER CONSERVATION NEWS
P. O. Box 942836
Sacramento, CA 94236-0001

Address Correction Requested

Improving Golf Course Irrigation Uniformity: A California Case Study

By D.F. Zoldoske, Ed.D., Director, the Center for Irrigation Technology

Golf courses located near cities and towns are a major competitor for urban water and energy supplies. As California faces the reality of 15 million new residents in the next 25 years, the pressure to extend existing water supplies will be unprecedented. This study was conducted to evaluate the experience of golf course superintendents who changed existing sprinkler systems with replacement nozzles to improve irrigation uniformity. Five golf courses participated in this study with a total of 606 irrigated acres representing 108 holes of golf (six 18-hole courses). The time span of data collection was one year before the nozzle change and one year of operation after the nozzle change.

While some golf courses had a reduction in applied water, others had an increase. The estimated total gross water savings, without adjusting for useful rainfall, for all the participants was 99.8 acre feet of water or 6.5 percent of the applied water. Adjusting for useful rainfall, the estimated savings falls to 5.7 percent of the applied water. Assuming the actual savings is somewhere in between, the estimated total savings of applied water was an average of 6 percent per golf course. Since all of the water on the participating golf courses is pumped, there is significant energy savings as well.

The average estimated gross water savings per golf course in this study (for 18 holes) is 16.6 acre-feet per year. For the purpose of illustration, let's assume the one-time cost of nozzle replacement is $12,000. The cost of water and energy would need to be $361 an acre-foot to achieve an estimated two-year payback period to recover the cost of re-nozzling based on the assumptions listed above. Water and energy costs higher than $361 would provide a shorter payback period, while lower water and energy costs would require a longer payback period to recoup the investment. Also higher or lower initial re-nozzling costs would effect this estimate, either positively or negatively.

A golf course uniformity test.

Additionally, the golf course superintendent will likely put a dollar value on any perceived improvement in turf quality, reduction in hand-watering, and/or playability of the course. This would favorably impact or shorten the payback period. Finally, each golf course that participated in this study had water savings either higher or lower than the average used in the example, so individual savings varied. The ultimate determination of whether re-nozzling is a viable option will be based on local economics, and must include all relevant conditions. A copy of the report is available online at http://cati.csufresno.edu/cit/index.html.